

NOTES ON SOME AMERICAN DRAGONFLY NYMPHS (ODONATA, ANISOPTERA)

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Dr. James G. Needham has amassed at Cornell University an excellent collection of American Odonata nymphs. It has been the writer's privilege to work over this material in preparation for its inclusion in his forthcoming "Handbook of the Odonata of North America." Many interesting points on the taxonomy of the immature dragonflies came to light during this work, the more important of which have been incorporated in the following notes.

ANAX LEACH

The genus *Anax* is well represented in American collections, in both the adult and immature forms, by the "Common Green Darner," *Anax junius*. This dragonfly has a wide distribution, being found in North and South America, Hawaiian Islands and on the west coast of Asia. Three other species of this genus are found in the New World. *Anax longipes*, with its race *concolor*, ranges from Massachusetts, Ohio, and Indiana, to Florida, Jamaica and Mexico. *Anax walsinghamsi*, "The Great Green Darner," the largest North American dragonfly, measuring 112 mm. total length, with a fore wing expansion of 124 mm., is restricted to California, Arizona, Lower California and Guatemala. The tropical *Anax amazili* ranges from Mexico and Central America to Brazil, Cuba and the Barbados, and has not hitherto been recorded from the United States.

The nymphs of *Anax*, while more or less known, are incompletely described and the records are in a chaotic condition. Louis Cabot (1881) described the first American *Anax* nymphs when he described *A. junius*, *A. amazili*, and mentioned *A. walsinghamsi* (Syn. *Aeschna validus*) and *A. longipes* in his mono-

graph of the immature stages of the Odonata. Dr. Needham (1904) described what he took to be *A. longipes*. *A. walsinghami* while known has never had a formal description.

The Needham collection yielded a large number of the nymphs of *A. junius*, one female specimen of *A. walsinghami*, and two males of *A. amazili*. No nymphs of *A. longipes* were obtainable.

Anax junius Drury

(FIGS. 3 AND 4)

The descriptions of *Anax junius* as given by Cabot (1881) and Needham (1901) are sufficient and need not be repeated here. The descriptions were made from reared material. The following are the distinguishing points. The "lateral lobes suddenly rounded off at end to incurved internal hook, not truncate." "Basal projection of the middle appendage of the male, half as long as lateral appendages." The mentum is 2 mm. wide at the base and 9 mm. long. There are no teeth on the distal border of the mentum. Length 40-52 mm.

Anax longipes Hagen

The writer has never seen the nymph of this species. Therefore, he is forced to take Needham's description in place of a specimen. The nymph is considered identical with *A. junius* except in the cases where Needham specifies otherwise. Length 55 mm.

Anax walsinghami McLachlan

(FIGS. 1, 5, 7)

Material: 1 full grown female from San Diego, California, dated "Aug. 15."

Description: Total length 58 mm. Length of abdomen 45 mm. Width of abdomen 11 mm. Width of head 10 mm. Length of hind femora 10 mm. Labium long and comparatively slender (Fig. 1). Base of mentum 4 mm. wide, length of mentum 12 mm., apical third little expanded over the proximal two-thirds, sides comparatively straight. Median cleft deep (.75 mm.). The

distal margin of the mentum with a deep fringe of hairs, in which, on either side and a little removed from the margin of the median cleft, are two small spines (Fig. 5). Lateral lobes squarely truncate, though somewhat rounded on the outer angle by a crescent-shaped piece of chitin. Lower angle ending in a strong tooth. Movable hook with a row of very fine nearly invisible setae (Fig. 7). Abdominal appendages: inferiors 7 mm., superiors 5.5 mm., laterals 4 mm. Lateral spines on segments 7, 8 and 9 well developed and sharp. Female genitalia 1 mm. removed from posterior border of 9. Coloration as in *Anax junius*.

Identity of species: I have assigned this nymph to *Anax walsinghami* because of its large size; 58 mm. in length. Obvious differences from *A. junius* and *A. amazili* makes confusion with these forms unlikely (see key). It is not *A. longipes* if Needham's (1904) description of that species holds good. Also, the wing venation as seen through the wing pads is very distinct and agrees better with *A. walsinghami* than any other *Anax*. The place of its collection (California), though frail evidence, favors reference to this species.

Anax amazili Burmeister

(Figs. 2, 6, 8)

Material: 2 males from Panzardi, Hato-rey, near San Juan, Porto Rico. Collected by Mr. Julio Garcia, September 15, 1926.

Description: Length 53 mm. Length of abdomen 39 mm. Width of abdomen 10 mm. Width of head 9 mm. Length of hind femora 9 mm. Labium comparatively shorter and broader (Fig. 2). Mentum 3 mm. wide at base and 10 mm. long. Apical third of mentum expanded more than basal two-thirds. Median cleft .50 mm. deep. Fringe of hair on the distal margin of the mentum heavy but short. A stout black tooth on either edge of the median cleft (Fig. 6). Lateral lobes squarely truncate. Superior angle square, chitinized; inferior angle with the usual heavy tooth. The movable hooks bear superiorly a row of heavy dark setae (Fig. 8). Basal projection of the superior appendage of the male one-third as long as the inferiors. Lateral spines on segments 7, 8, 9, and coloration as in *A. junius*.

Identity of Species: While no reared material is at hand I have no hesitancy in assigning the above nymphs to *A. amazili*. They agree with Cabot's inadequate description of this species. One of the two nymphs would have emerged in a very short time, so the adult wing venation is easily visible through the pads. A more convincing point, however, is arrived at when the head is partially cleared in carbol-xylol. After this treatment, two dark lateral triangles and a light triangular spot can be readily seen on the frons. The geographical location, coloration and structural characters and elimination (see key) all favor reference to *A. amazili*.

Remarks: In Cabot's (1881) account of the nymphs of *Anax* he fails to mention the prominent black teeth on the mentum of *amazili*. However, under his description of *A. junius* he says, "Several specimens from San Diego, California, differ in having *black teeth* in the middle of the comb of the front border of the mask." He thinks that this may be the nymph of *A. walsinghami*, but goes on to say, "Nevertheless, it seems doubtful that nymphs very similar to *Anax junius* should belong to the gigantic and very different *A(eschna) validus (Anax walsinghami)*. In view of the specimens on hand it is possible that Cabot's smaller *junius*-like nymph with the black teeth (Fig. 6) on the mentum is *A. amazili*, and that Cabot never saw the larger *A. walsinghami* with its two spines (Fig. 5) on the mentum instead of teeth. The geographical location (California) recorded by Cabot for this nymph is against this idea, for it would be by far the northernmost record for *amazili* and the only one from the United States.

The following key will separate the New World nymphs of the genus *Anax* as I conceive them to be:

KEY TO ANAX NYMPHS

1. Lateral lobes of the labium tapering to a hooked point. Basal projections of the superior appendage of the male half as long as the inferiors. No teeth on the mentum on either side of the median cleft(2)
- Lateral lobes of the labium squarely truncate, a little rounded on the superior angle. Small teeth on the mentum on either side of the median cleft(3)

2. Lateral abdominal appendages half as long as the superiors. Superior margin of the superior abdominal appendage very convex.....*longipes?*
Lateral appendages less than half as long as the superior. Superior margin of the superior abdominal appendage not extremely convex. A common species.....*junius*.
3. Movable hooks with a row of heavy dark setæ. Teeth on either side of the median cleft stout and black, located on the very brink of the cleft, well exposed. Basal projection of the superior abdominal appendage of the male one-third as long as the inferiors.....*amazili*.
Movable hooks with a row of very fine almost invisible setæ. The teeth on either side of the median cleft small and thin, removed a little distance from the edge of the cleft, hidden among heavy hairs.....
.....*walsinghami*.

AESHNA FABRICIUS

Since the publication of Dr. E. M. Walker's (1912) monograph of "The North American Dragonflies of the Genus *Aeshna*," little has been done on this group. Dr. C. H. Kennedy described two new species—*A. arida* (1918), *A. walkeri* and its nymph, and the nymph of *A. interrupta nevadensis* (1915); Dr. Walker (1921) described the nymph of *A. sitchensis*. The following nymphs are as yet unknown: *A. cerulea septentrionalis*, *A. interrupta interna*, *A. ventricularis*, *A. mutata*, and *A. arida*. The Needham collection contains a reared specimen and cast skin of *A. tuberculifera*; the description of this specimen follows:

Aeshna tuberculifera Walker¹

(FIG. 9)

Material: 1 reared male and cast skin bearing the label, "Pond between Harrisville and Natural Bridge in Lewis County, N. Y., July 4, 1923."

Description: Length 45 mm. Abdomen 32.5 mm. Width of abdomen 8 mm. Width of head 8.25 mm. Length of hind femora 7 mm. Hind wing pad 10 mm. Labium long, 10 mm. from tip to

¹ *Aeshna tuberculifera* was originally described by Dr. E. M. Walker (1914), and figured by R. H. Howe (Manual of Odonata of New England). It has been redescribed here because of the difference in my specimen from the ones previously described and to separate it from *A. umbrosa*, its nearest relative.

hinge. Mentum strongly narrowed in proximal half but expanded in the distal half, the width at the base (2 mm.) being less than half that at the apex (5 mm.). Length of mentum 7.5 mm. A small tubercle at either side of the median cleft. Setae on movable hook few but comparatively long. Lateral lobes squarely truncate, inner angle ending in a small hook. Eyes prominent, the antero-posterior diameter a little longer than the transverse diameter. Lateral margins of the head straight. Posterior-lateral angles of the head prominent but well rounded. Hind margin nearly straight.

Supracoxal processes well developed, conical, the posterior lobe slightly the larger.

Abdomen slender, widest at segment 6. Lateral spines on segments 6, 7, 8, 9, those on 6 rudimentary. Abdominal appendages, inferiors 4.5 mm., laterals 2.5 mm.; superior 4 mm. Apices of laterals very slender and fine-pointed.

Coloring as in *Aeshna umbrosa*. The annuli on the legs are very pale in my specimen though easily distinguishable. Also the median pale band is hardly distinguishable from the lateral brown ones. The median spots are prominent and are distinctly bilobed on segments 7 and 8. The lateral scars are obscure.

Remarks: *A. tuberculifera* is remarkably like *A. umbrosa*, to which it would run in Walker's (1912) key. The principal differences between the two species are to be found in the labium (Figs. 9 and 10). The mentum is longer in proportion to its width in *A. tuberculifera* (2 mm. : 7.5 mm. in *A. tuberculifera*; 2 mm. : 6.5 mm. in *A. umbrosa*). The setae on the movable hooks are longer in *A. tuberculifera*. *A. umbrosa* lacks the small tubercles on either side of the median cleft, found in *tuberculifera*. The antero-posterior diameter of the eyes is greater than the transverse in *A. tuberculifera*, the same in *umbrosa*, and the inferior appendages tend to be shorter. In my specimen the annuli on the legs are more obscure than in *umbrosa*. However, they are present on both tibia and femora.

Sympetrum Newman

Dr. E. M. Walker (1917) published an account of the nymphs of the genus *Sympetrum*, to which I have little to add. One cor-

rection should be noted on page 409. *S. madidum* is listed among the undescribed species. Needham (1904) published a description of a nymph he supposed to be that species. The North American nymphs of *Sympetrum* remaining undescribed are *S. ambiguum* (syn. *S. albifrons*), *S. atripes* and *S. verum*.

Sympetrum pallipes Hagen

(FIG. 11)

Walker (1917) described this nymph and figured the labium. In the Cornell collection there turned up a reared nymph of *pallipes* differing greatly and in a peculiar manner from the one described by Walker. This specimen was reared by Dr. Needham at Dry Lake, Utah, July 22, 1926. The adult is a teneral male, with hamuli and superior appendages almost identical with those of *S. obtrusum*. However, although teneral, its color seems distinct enough to separate it from the above-named species. The black band before the eyes and the black tibia and tarsus of the *obtrusum* group are lacking in this specimen; and as the hamuli readily separate it from *S. ambiguum*, *S. pallipes* is the only reasonable identification.

This nymph agrees well enough with Walker's description except that the dorsal hook on segment nine is lacking and the distal margin of the mentum in outline is dome-shaped instead of conical as in the one figured by Walker for *S. pallipes*. The modification (Fig. 11) is very distinct and segregates this nymph from all other *Sympetra* at a glance, yet there is nothing peculiar about the adult. This is a curiosity that I can not explain.

Sympetrum illotum Hagen

While known and figured this species has never been formally described. The following description is from an unpublished manuscript written by Dr. James G. Needham:

"I have twice published figures of the nymph of this species without description (Out-door Studies, figs. 68, 69, 70, on pp. 66 and 67, and Bull. N. Y. State Museum No. 47, plate 25, fig. 1). In 1897 Mr. R. W. Doane sent me specimens from California, and two years later Professor Kellogg sent me reared specimens

from the Stanford University Collection (Lot 143, Sub. 28). In describing the closely related *S. corruptum* in Bull. 68, N. Y. State Museum, p. 271, I compared the nymph of that species with this one in some characters, but I will here give a fuller description.

Length 18 mm., abdomen 10 mm., hind femur 5 mm., width of head 5 mm., of abdomen 6.5 mm.

Body rather smooth except on the margins which are thinly hairy, slightly depressed, stout. Head wider than long with eyes directed antero-laterally, and rather prominent at the sides, the margins of the head behind the eyes sloping to the nearly straight hind margin. Labium large and thin, the hinge reaching posteriorly to the middle of the mesothorax. Legs slender, tibiae fringed externally with long thin hairs. Wing cases reaching posteriorly as far as the 6th abdominal segment.

Abdomen widest in the middle, depressed, triquetral, the sides regularly curving toward each other at both ends, abruptly terminating at the apex of the 9th segment, which is concave dorsally, and includes the annular 10th segment. Dorsal hooks wanting. Lateral spines minute—excessively minute on the 8th segment, larger on the 9th, where short triangular and convergent at tips. Appendages short, about as long as segments 9 and 10 together upon the dorsal side, superior a little shorter than the inferiors and the laterals one-third shorter than the inferiors.

Median lobe not toothed nor crenate: mental setæ about 13 each side the 4th or 5th (counting from the side) longest: lateral setæ 9: hook very slender, setiform, incurved only at tip: teeth low, each armed with several graduated spinules''

TRAMEA HAGEN

In the Odonata collection at Cornell University there are three reared specimens and exuviae of *Tramea onusta*. The material, two males and one female, was reared by Dr. James G. Needham at a pond in Laguna Canon, Southern California, August 31, 1922. The nymph of this species has never been described.

Tramea onusta Hagen

The nymph measures in length 24 mm. Abdomen 15 mm. Width of abdomen 9 mm. Width of head 8 mm. Length of ab-

dominal appendages: dorsal 2.5 mm., laterals 2 mm., inferiors 3 mm. Ratio of abdominal appendages: lateral one-third shorter than the dorsal, lateral one-fifth shorter than the inferiors, dorsal one-sixth shorter than the inferiors. Lateral setæ 11 (not counting the small accessory one that is sometimes present just above the hinge). Mental setæ 14-16, outer 2-9 longer and close set, 6 longest. Antennæ with the fourth joint two-thirds as long as the third. It resembles the nymph of *T. lacerata* in general appearance and has less pigment than that of *T. carolina*, as indicated in the following key:

KEY TO THE NORTH AMERICAN NYMPHS OF THE GENUS
TRAMEA

1. The 4th joint of the antennæ half as long as the third. No brown spot on the labrum. Lateral setæ 11.....*lacerata*.
The 4th joint of the antennæ two-thirds the length of the 3rd.....(2)
2. The dorsal abdominal appendage as long as the laterals. Laterals one-third shorter than the inferiors.....*abdominalis*¹
The dorsal abdominal appendage shorter than the laterals.....(3)
3. Lateral setæ 11. Lateral abdominal appendages one-fifth shorter than the dorsals. Laterals one-third shorter than the inferiors. Dorsal one-sixth shorter than inferiors.....*onusta*²
Lateral setæ 10. A distinct brown spot on the labrum. Lateral abdominal appendages one-third shorter than the dorsal. Laterals three-sevenths shorter than the inferiors. Dorsal one-seventh shorter than the inferiors.....*carolina*.
4. Unknown*insularis, cophysa, and virginica*.

¹ The characteristics of *T. abdominalis* used in this key were taken from Cabot's description of the nymph. The writer has never seen a specimen.

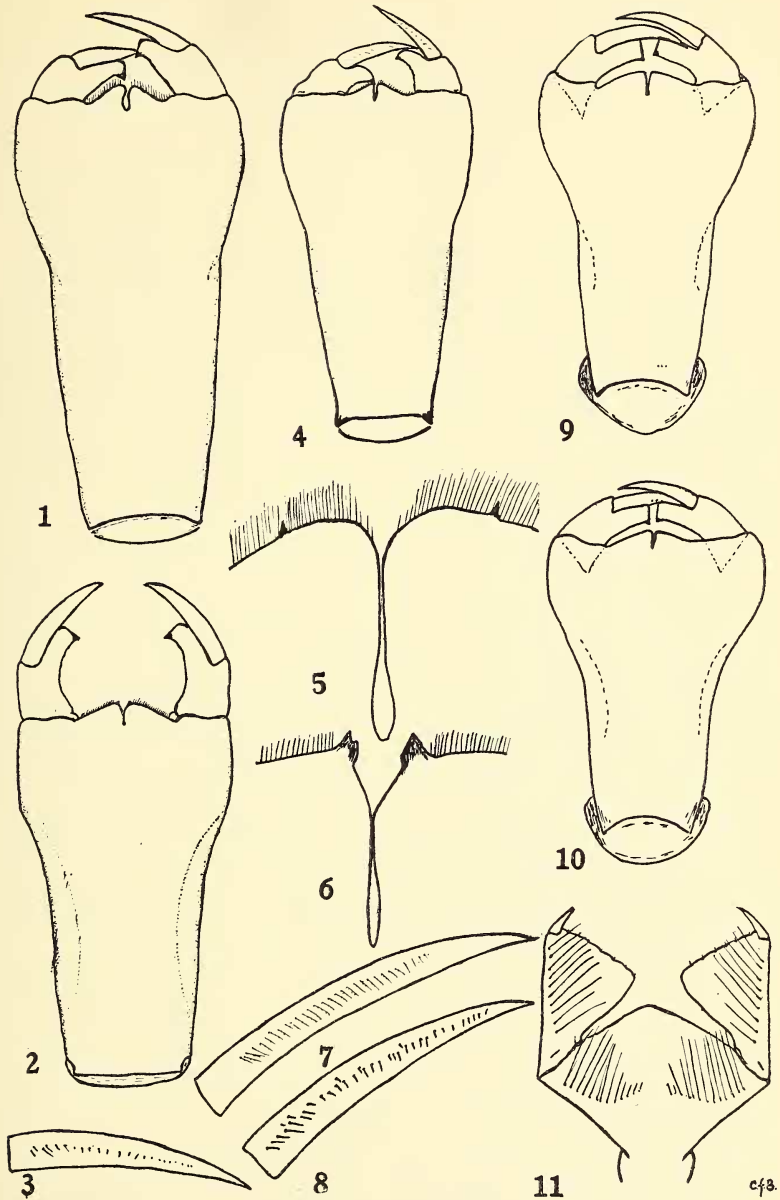
² The separation of the nymphs of *Tramea* is a difficult task because, like the adults, the characters distinguishing the species are very slight. The ratios given in the above key for the comparative length of the different abdominal appendages, I believe will hold. However, those for *T. onusta* were taken from three exuvia, two male and one female, and while measurements were exactly the same for these three, a larger series may break them down. I cannot determine from the exuvia of *T. onusta* if the labrum has a brown spot or not, but am inclined to believe that it has not. The counting of the lateral setæ does not include the small accessory one sometimes present just above the hinge.

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EXPLANATION OF PLATE V

- Fig. 1. Labium of *Anax walsinghamsi*.
- Fig. 2. Labium of *Anax amazili*.
- Fig. 3. Movable hook from labium of *Anax junius*.
- Fig. 4. Labrum of *Anax junius*.
- Fig. 5. Distal border of mentum of *Anax walsinghamsi*.
- Fig. 6. Distal border of mentum of *Anax amazili*.
- Fig. 7. Movable hook from labrum of *Anax walsinghamsi*.
- Fig. 8. Movable hook from labrum of *Anax amazili*.
- Fig. 9. Labium of *Aeschna tuberculifera*.
- Fig. 10. Labium of *Aeschna umbrosa*.
- Fig. 11. Labium of *Sympetrum pallipes*?



ANISOPTERA NYMPHS